

Estimating Juvenile Chinook Salmon Spring and Winter Run Abundance at Chipps Island

#0084

Technical Panel Review

Proposal Name: Estimating Juvenile Chinook Salmon Spring and Winter Run Abundance at Chipps Island

Applicant Organization: U.S. Fish and Wildlife Service

Principal Lead Investigator(s):
Brandes, Patricia

Amount Requested: \$483,903

TSP Panel Summary of Findings:

The panel agreed that this is important, much needed research. This well-qualified research team has submitted a reasonable budget to conduct interdisciplinary analyses. This is an extremely well-put-together proposal. It is crucial to have a reliable method to monitor the response of the salmon population to the improvements that are currently being implemented in the Bay-Delta system. Sampling of these fish is already supported by agency monitoring programs, but the panel acknowledged that current monitoring methods are not sufficient. Currently, managers rely on seemingly flawed size at season criteria.

However, the panel found some details of this proposal to be lacking. Details of the critical sampling plan (how will the 3000 fish/yr be divided over the seasonal catch to sufficiently index low populations), estimation of trawl efficiency, and the quantitative synthesis of genetic and trawl to estimate population abundances were all lacking. Also, it seems somewhat optimistic to be able to develop meaningful relationships between outflow/water use and abundance based on 3-4 years of data. Finally, more products could be produced for the requested amount of money (i.e. Submit more than one research article).

The panel views this project as a demonstration project to show how this new monitoring method will work. After demonstration of project success, there would likely be more

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management buy-in and adoption.

Relevance to PSP Topic Areas:

High

TSP Technical Rating:

Above Average

TSP Funding Recommendation:

Fund w/conditions

TSP Amount Recommended: \$483,903

Conditions:

The panel recommends the deliverables for the project include a white paper guiding the conditions for future monitoring.

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Proposal Title: Estimating Juvenile Chinook Salmon Spring and Winter Run Abundance at Chipps Island

Proposal Number: 0084

Proposal Applicant: U.S. Fish and Wildlife Service

Purpose

Comments	<p>The goal of this proposal is stated to be estimating the relative timing and annual abundance of winter- and spring- run Chinook salmon passing Chipps Island for three consecutive years. It aims to accomplish this by designing a sampling plan to accurately estimate race composition of spring- and winter- run Chinook salmon at Chipps Island by using DNA analysis, collecting and analyzing DNA samples according to this design, and obtain peer review and disseminate findings. The proposal's conceptual model was not developed sufficiently to assess how it would link the proposal's objectives with the goal of estimating abundance, although the approach for this seems consistent throughout. The proposal contains a clear statement of the problem in the Description and linkage of this problem to the goals, but there is no clear hypothesis identified for the proposal. The purpose of the project is timely and important and represents changing an outdated monitoring paradigm (size-at-date race criteria; Johnson et al 1992) to utilizing the best available science (Banks 2005) for assessing Chinook race timing through and composition in the Delta. The study is justified considering the accuracy of the molecular method, the knowledge that the current paradigm introduces large errors into abundance estimates presently calculated, and current lack of information concerning the temporal and spatial abundance of threatened Spring-run Chinook in the Delta. The goals and objectives are consistent</p>
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	<p>throughout the proposal, considering the current reliance of management of outdated models for estimating threatened Chinook races abundance in the Delta (a region of considerable impact on these runs). The length of this study and the pilot work, that appears to have been completed (multiple supporting Figures), should support this project attaining its objectives. Results from this study should add to the base of knowledge for Spring-Run Chinook concerning timing and composition, but it is not clearly written into the proposal how these data will be transformed quantitatively to estimate abundance. Proposal proponents suggest reviewers reference USFWS reports concerning trawl efficiencies to understand the quantitative model linking proposed work for assessing timing and composition with abundance estimates, instead of providing necessary description for review. This project will use novel methodologies and approaches to generate information about threatened Chinook races, which managers cannot accurately obtain given the inaccuracy of the size-at-date race criteria. It is likely that managers will learn considerable information concerning the temporal and spatial demographics of these Chinook race from this project.</p>
Rating	Above Average

Background

Comments	<p>The conceptual model shows a single linkage between spatial occupancy and timing of Chinook races in their freshwater phase to a monitoring location (Red Bluff Diversion) and does not explicitly contain the Chipps Island site, which is used by the proposed project. The conceptual model includes acronyms not used in the proposal, stading for Juvenile Production Index or Estimate, that should have been included in the model description to tie the proposal together better. While the background and conceptual model section includes additional details concerning direct export related mortality, the model (Figure 6) does not demonstrate</p>
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	<p>the relationships between the proposal's results and its goal of discerning Chinook race abundance using a new method. The conceptual model does not explain the underlying basis for the proposed work, although in the written description of the model its proponents are able to link the scope of the problem with the model. The conceptual model does not appear to represent the proposed work, but the current paradigm for estimating abundance and impacts of only Direct Loss on various life history stage (Spawner, Smolt) abundances. The proposed work should allow managers to discern more accurately the impact of Loss in the in-river and the Delta on the specific Chinook races, which is critical information for management. Since this proposal contains state-of-the-science work to more accurately describe the model, it would have been nice to see an updated model integrating the proposal's new methods and results, freshwater survival, and Delta abundances, as mentioned in the written Background and Conceptual Models Section. While the purpose and motivation behind the proposed work is clearly described in the proposal and would indicate this work is critical to bringing management of these Chinook races in the Delta up to par with the best available science, the conceptual model needed to understand how the proposed work is distinct from the current status quo is not well documented. It is likely that the molecular data will be easily assimilated into the current trawl efficiency and race abundance estimate methodologies. However, given the minimal information in the conceptual model concerning the proposal's methods for quantifying population demographics, the utility of the results is not as well documented as possible.</p>
Rating	Sufficient

Approach

Comments	The approach is well designed and appropriate for establishing the utility of the molecular method and incorporating it into a new management paradigm for
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	Chinook races in the Delta. The tasks and work plans associated with objectives make sense given the current outdated management model using size-at-date. The proposal has identified 50% of the administrative and management personnel of the project in the Task and Budget Summary under Project Management. The resulting products from this project will be of fundamental and tremendous value to managers currently using outdated models for Chinook race discrimination and using timing and Delta stock composition estimates for assessing impacts to these threatened species. The plan for dissemination of information gained from the project will be capable of widespread and effective communication to managers, scientists, and stakeholders.
Rating	Superior

Feasibility

Comments	The approach is full documented, except for explanations of how molecular data can be combined with trawl efficiency data for estimating abundances of Chinook races. It seems likely from the proposal that the approach will "improve upon existing methods for estimating catch efficiencies by using statistical and modeling expertise to determine the best way to estimate trawl efficiency and associate confidence limits and apply them to catches of "true" juvenile winter- and spring- run Chinook salmon" (Task 4.1 description), but an actual approach to doing this is never given, only an explanation for the molecular methods for deriving the "true" catch estimates. The other tasks' approaches appear to be technically feasible and the approaches have been the subject of numerous peer-reviewed articles and agency working protocols. There is very high likelihood of success given the successful track record of the proposal's proponent to synergistically contribute to cooperative, multidisciplinary ecological and molecular research. The scale of the project is consistent with the objectives and within the grasps
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	of the proposal proponents.
Rating	Above Average

Budget

Comments	The budget appears clear and thorough describing the salaries and expendable costs associated with each task. The budget appears adequate and reasonable for the work proposed. The CESU agreement with OSU (Dr. Banks) and the potential for samples to be collected by a long-term funded monitoring study are advantages of the budget.
Rating	Superior

Relevance To CALFED

Comments	The proposal's suggests it addresses two of the priorities states in the PSP, specific to threatened Chinook salmon races. The goals and objectives clearly state how it will meet the first priority of 1) identifying trends and patterns of populations and system response to a changing environment, but only superficially demonstrates how results will be able to benefit species by 2) using discretionary environmental water supplies more effectively for at-risk species. The proposal's conceptual model does not directly show (nor does its description clearly explain) how the results of the project are related to these priorities: 1) identifying trends and patterns of populations and system response to a changing environment and 2) using discretionary environmental water supplies more effectively for at-risk species, although these are reasonable simple relationships to hypothesize in the model. The proposal addresses other CALFED priorities by bridging mathematical and molecular disciplines to integrate information for understanding Chinook race timing and composition (and likely abundance) at various temporal scales. It could result in a new management model for assessing impacts of various water conditions on Chinook survival at
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	discrete spatial scales (in river, Delta). The information should be of fundamental importance to CALFED resource managers and policy makers, since it will be essentially evaluating and reinvigorating the outdated management paradigm of size-at-age for the at-risk winter- and spring-run Chinook salmon. The attached letters of support from DWR, NMFS, CDFG indicate the importance of this work and its results to achieving the Science Programs purpose of identifying trends and patterns of populations to a changing environment, with regards to the at-risk Chinook races.
Rating	Superior

Qualifications

Comments	The track record of the proposal's author indicates their involvement in coordination of multi-agency, interdisciplinary management teams and models. It appears Ms. Brandes and the project team have the available infrastructure and other aspects of support necessary to accomplish the project in an efficient and effective manner.
Rating	Superior

Overall Evaluation Summary Rating

Comments	In summary, I believe this proposal is above average. The necessity to accomplish such work to update the outdated size-at-date method for discriminating Chinook races in the Delta is fundamental to protecting and reducing loss of these listed Chinook races. The proponent's qualifications, proposed approach, and the budget for accomplishing the proposal are superior. The approach and methods should effectively provide the necessary results to advance management of water resources to benefit at-risk species, and are explicitly
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	<p>laid out in the proposal, except with regards to transforming the composition estimates into abundance estimates. It appears the quantitative methods for doing this are outlined in various USFWS documents cited in the proposal, thus this step should be efficiently completed, but not enough information is provided in the proposal to determine this. The lack of description in the proposal for how this information and other results can be integrated into a basic conceptual model concerning quantifying Chinook race abundance and survival keeps this proposal from being viewed as superior. How the results might be used to differentiate in river vs. Delta loss of Winter-run is not developed, but a critical and fundamental product of this proposal that would be quite useful to CALFED resource managers and policy makers.</p>
Rating	Above Average

External Technical Review #2

Proposal Title: Estimating Juvenile Chinook Salmon Spring and Winter Run Abundance at Chipps Island

Proposal Number: 0084

Proposal Applicant: U.S. Fish and Wildlife Service

Purpose

Comments	<p>The goals, objectives, and hypotheses of this proposal are clearly stated. This project aims to increase our understanding of juvenile outmigration patterns for two different (listed) runs of Chinook salmon. This information is vitally important in estimating abundance of these two runs and their survival through different life stages. This information has been desperately needed for a long time but, given new advances in the DNA markers used to identify the different runs, this project is now completely justified relative to existing knowledge.</p> <p>Currently, the relative proportion of different runs of Chinook salmon outmigrating from the Delta is estimated based on what amount to guesses about the lengths of juveniles of different runs as they pass through the Delta. The error surrounding these estimates is likely to be huge (the authors demonstrate a pretty high scatter for winter run in their figures -- the size-spread technique underestimates the size of the winter run). Meanwhile, all activities upstream (from passage improvements and diversion screens, to floodplain restoration, to different dam release strategies) are evaluated with regard to their impact on the proportion of outmigrating juvenile salmon in these two runs. Unfortunately, these same upstream activities are likely to produce inter-annual differences in the sizes of outmigrating juveniles -- this then calls</p>
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	<p>into question the original estimate of proportions of the different runs. Resolving these uncertainties is crucial to both effective management to protect the listed runs (e.g. from mortality at diversions) and evaluation of restoration activities upstream. Simply put, we cannot estimate survival from upstream to the Delta or survival from the delta to the ocean and back to the delta (as audlts) if we do not know how many juvenile chinook salmon leave the Delta. If we can't measure relative survival rates upstream or in the ocean, we have no way of knowing whether management activities have a positive or negative effect on salmon. This study will make a big step towards solving this big problem.</p>
Rating	Superior

Background

Comments	<p>The authors' case is clearly stated and, for those familiar with the system, well-understood. Estimating salmon juvenile survival is a problem throughout the literature on salmonids and other migratory fish species.</p> <p>The authors could have spent a little more time explaining the current methods of estimating abundance and survival (the flow diagram helps but I could have used more explanation to improve understanding -- perhaps an example from a particular year's calculation). These methods rely on several assumptions stacked on top of each other. As a result, current estimates of abundance of these two runs (and really, all the fish in this ecosystem) are subject to huge uncertainties because the underlying assumptions used to convert sampling data to actual estimates are known to be chronically flawed.</p>
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	<p>The figures showing the distribution of genetically identified winter run salvaged at the pumps are illustrative. The year by year comparison of salvage estimates based on size criteria vs. genetic identification make two important points: (1) the size criteria appear to routinely overestimate the loss of these two runs at the pump and (2) the proportional overestimate varies substantially from year to year. These two results indicate that our current understanding of spring-run and winter-run migration dynamics may lead to water-system management that is sub-optimal for the fish and other resource uses.</p>
Rating	Superior

Approach

Comments	<p>The authors want to apply newly developed statistical patterns in genetic markers to the identification of field samples of spring run and winter run chinook salmon. The current method for identifying these runs is to assign individual fish to the different runs based on their size. The size demarcation is largely based on previous samples of tagged hatchery fish. This method is only partially accurate and its accuracy likely changes from year to year as growth rates vary with rearing conditions (these two runs begin their lives in very different kinds of watersheds and so can be differentially affected by outflow, temperature, etc.). Genetic identification of these runs will be the gold standard for run identification and will absolutely increase our understanding of things like run timing, delta residence, early life stage survival, and other ecological attributes important to management.</p> <p>The author's want to design a statistically valid sampling regime that will (a) allow depiction of the temporal extent of both runs' migrations through the</p>
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delta and (b) allow for accurate interpretation of sampling results (i.e. how do sampled fish reflect the population as a whole). This is vitally important. I want to emphasize, that every abundance estimate of every fish species in this ecosystem is subject to large amounts of uncertainty because of the assumptions made to calculate abundance. While these assumptions are constant from year to year, the life history and ecology of organisms (especially salmon) varies a bit based on annual rainfall and temperature patterns; thus the effect of the assumptions on abundance estimates changes from year to year (see their figure 1). I applaud any effort to improve the statistical merit and accuracy of abundance estimates in this complex ecosystem.

The author's also want to use modelling and statistical techniques to determine the sampling efficiency of their gear. This will allow them to determine how to "expand" their sampling results to a larger population estimate. The current method for doing this is a kind of Rube Goldberg statistical device that looks ok on paper but, like many fisheries statistics, makes too many assumptions to be believable (unless that's all you have to go on). Improved estimates of gear efficiency are needed throughout this ecosystem and the author's are seizing this opportunity to really study the question: "how many fish are in the water if I catch X fish in the net?"

The "weakness" in the approach presented here is that the authors have not identified the statistical approach they will use for either the "sampling design" questions or the "gear efficiency" questions. This is because they have not yet identified their statistical partner/collaborator. I am more than a little confused as to why Newman is not the statistician they will use. They write that Newman is being added to the USFWS staff in Stockton (where Brandes is located) and he seems to be an excellent

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	<p>choice to do the statistical work. He is already working in the system so, whether or not he gets added to the USFWS team, he should be a part of their proposal. In any case, the sampling design question is not a large problem because a competent biostatistician should be able to understand and address it. Should the proposal be funded, I strongly encourage the authors to find a statistician who is willing and able to study and understand the physical (hydrodynamic) and ecological complexity of this system because that is where the difficulty in sampling design emanates from.</p> <p>The gear efficiency problem is more complex than the sampling design question. Again, it should be within the grasp of numerous biostatisticians and again I don't understand why Dr. Newman is not clearly their choice to do this work. Nevertheless, the authors state that, if Newman is not the statistician that does the work, they will obtain approval for whoever they do choose. In that case, CBDA should expect that the team include a statistician with a track record in fish population sampling design and real field experience with pelagic sampling. In this case, it is truly important that the statistician understand the sampling of fish -- the sampling techniques are different than for most other organisms -- and that they understand the ecology of Sacramento river salmon and a bit about hydrodynamics in our Delta. The "real-world" component of this task is the challenging part.</p>
Rating	Above Average

Feasibility

Comments	<p>What the authors have outlined is a comprehensive and ambitious program to study the meaning of a sampling program that has a long and established record. This team has already performed the truly challenging parts of this task (the genetic analyses and the actual sampling of the fish). They have the infrastructure in</p>
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	<p>place to complete this task and are the best positioned people to perform this absolutely critical research. The statistical approach is yet undefined. Still the a large part of the field of statistics was designed to answer the question: how do we determine how many of [blank species] their are in this habitat? As a result, even if Newman were not part of the team, there should be enough Master's or Ph.D. statisticians with LARGE AMOUNTS OF EXPERIENCE designing actual field sampling protocols in complex environments, to make this task completely doable.</p> <p>The team should [be required to?] submit more than one manuscript (as they propose) to a peer-reviewed journal. THis project has the potential to produce at least one methodology oriented paper (e.g., "DNA anlayses in population estimation", "assumptions about gear efficiency" etc.) and at least one "population status based on new estimation techniques" paper</p>
Rating	Superior

Budget

Comments	<p>The budget is EXCEPTIONALLY reasonable. It is not clear how adding Dr. Newman as the statistician will impact the overall budget but I have to believe the cost will decrease relative to the expense of hiring a consultant. The bulk of the budget goes to complex genetic analysis of large numbers of fish. The processing of this number of fish was not possible 10 years ago and, if it were, it would have cost about 10 times the amount requested.</p>
Rating	Superior

Relevance To CALFED

Comments	<p>This proposal clearly meets the requirements of this PSP as it will produce information about how organisms respond to interannual changes (inter-annual climatic)</p>
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	<p>in their environment and also the potential impact of "environmental water". Our current lack of understanding of the early life history for these two listed runs potentially costs CBDA and others many many millions of dollars. This team WILL make large steps to rectify this knowledge gap. The information generated by this study will probably be used by water-supply decision makers before the study is even complete. The results of this study will certainly be an important part of the basis for water-supply management within 5 years. In other words, this is a very important study that will almost certainly produce valuable results that will impact CBDA-partners' management activities.</p>
Rating	Superior

Qualifications

Comments	<p>The team's qualifications and track record are exceptional Brandes has produced numerous studies of salmonid outmigration through the Delta. Doubtless, she will be able to leverage her previous work in the context of this study to develop a truly meaningful understanding of the forces that control natural variance in Chinook salmon outmigration from the Delta.</p> <p>Banks has an excellent track record in race identification using these genetic techniques and studying these particular races of salmon.</p> <p>Both Brandes and Banks have all the infrastructure resources they need to complete this project successfully. I cannot imagine that they will not produce all the results they anticipate. The combination of two leaders with such experience in this system augers well for the success of this project.</p>
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	<p>One potential weakness is that they have not yet identified the statistical expert who will help them design an effective sampling program. While determining how to allocate fishing effort to cover the different runs is a critically important piece of this project, it is one that should be in the reach of many competent biostatisticians (provided that person has sufficient experience with real-world sampling design and is given plenty of exposure to the actual physical environment so that they can understand the many factors at play in the sampling). IF we knew that Dr. Newman would be the biostatistician on this team, I would rate their qualifications as "superior".</p>
Rating	Above Average

Overall Evaluation Summary Rating

Comments	<p>This is an outstanding proposal. The authors' make a clear case for the importance of filling the knowledge gaps they are addressing. Their documentation of the problem speaks well of their focus, organization, and ability to work together.</p> <p>The benefit: cost ratio here is extremely high (100's or 1,000's to one, depending on the time frame and how one does the math). The probability of success: risk of failure ratio is similarly high (barring catastrophe, this team is very well-positioned to do this job). The time horizon for important results is also quite good. This study will answer some very important questions in three years.</p> <p>It is possible that the team will need to come back at the end of three years for additional years of study. With luck they will encounter radically different climatic conditions in their three years of sampling and this will tell us whether patterns in outmigration are generalizable across outflow conditions or</p>
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	<p>whether DNA sampling of outmigrants is required in additional years to fully characterize the natural variability in run migration timing. This in itself would be a hugely important piece of information.</p> <p>I strongly encourage funding of this proposal and I strongly encourage CBDA to require this team to produce more than 1 peer-reviewed submission to a national or international scientific journal.</p>
Rating	Superior

External Technical Review #3

Proposal Title: Estimating Juvenile Chinook Salmon Spring and Winter Run Abundance at Chipps Island

Proposal Number: 0084

Proposal Applicant: U.S. Fish and Wildlife Service

Purpose

Comments	The applicants make a clear case for enhancing methods to differentiate races of Chinook salmon emigrating from the Delta. The size-at-date criteria and trawl efficiency estimates based on CWT recoveries seem crude in light of new genetic techniques. Inaccuracies generated by these antiquated methods may have serious implications for threatened stock recovery efforts and certainly do little to advance our understanding of demographic trends in Central Valley spring and winter-run Chinook. The proposal is clear, concise, and focused on the objectives. The successful application of DNA analysis to distinguish runs and life history types of Sacramento River Chinook and the project team's expertise lend credibility to the proposal.
Rating	Superior

Background

Comments	Background information in the proposal clearly identifies the problem: inaccurate identification and hence poor abundance estimates of spring and winter-run smolts lead to inaccurate estimates of losses due to water management activities. The conceptual model bounds the situation but the proposed concept (improved estimates of freshwater survival for two stocks) is dependent on estimates or indices of adult and fry abundance that are
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	beyond the scope of the project. If the errors in size-at-date run determination are as great as those cited at CVP and SWP fish facilities, improved estimates at Chipps Island will benefit Chinook recovery irrespective of other efforts.
Rating	Above Average

Approach

Comments	The approach is well designed, incorporates methods and analyses based on prior research in the Delta, and is linked with ongoing monitoring projects in the study area. The objectives and tasks are arranged logically and the entities responsible for each component of the project are clearly identified. I am impressed by the fresh approach to new sampling designs (Task 1.1) and the adaptive nature of the project (Task 1.3). The DNA analysis portion of the project will be performed by preeminent scientists and I am confident this aspect of the study will yield valuable results. Some aspects of the catch efficiency component of the study (Task 4.1) are less clear. I agree that improvements to the CWT recovery based survival estimates are warranted but too little information is provided to gauge the potential value of "statistical and modeling" efforts. The plan for disseminating findings is reasonable and all members of the project team present and publish findings of CALFED related research.
Rating	Superior

Feasibility

Comments	Because the project relies on well funded ongoing efforts to collect juvenile Chinook at Chipps Island, I am confident the sampling component is feasible. The Oregon State University genetics lab has an excellent track record and I trust that Dr. Banks and his colleagues will accomplish the DNA analysis tasks.
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Rating	Superior
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Budget

Comments	The budget is detailed and very well presented. The time allocated to each component of the study seems reasonable. Collaboration with Oregon State, ongoing USFWS monitoring, and IEP and CVPIA genetic sampling generate tremendous cost savings and matching funds. These relationships represent 3 times the requested funding for this proposal.
Rating	Superior

Relevance To CALFED

Comments	The project is relevant to the two priority research topics listed in the proposal: 1) identifying trends and patterns and 2) using water supplies more effectively. As is the case with any fisheries study in the complex Delta ecosystem, the results of this project must be integrated with other efforts. Throughout the proposal the applicants have identified how their information can be integrated with past and present investigations to affect management decisions. I believe the applicants overstate the ability of their 3-year effort to identify population trends and make comparisons across years. However, results from this project may challenge long-standing assumptions about fish movement, distribution, and survival and the project is likely to enrich the body of data used to regulate CVP and SWP exports.
Rating	Above Average

Qualifications

Comments	The project team's qualifications are excellent. The principal investigators, Brandes and Banks, have well established reputations conducting fisheries research in
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	the Delta. Brandes has more than 20 years experience studying salmonid abundance, distribution, and survival. As a preeminent geneticist with more than a decade of experience researching Central Valley salmonid stocks, Banks is uniquely qualified to perform the work.
Rating	Superior

Overall Evaluation Summary Rating

Comments	The background information justifies application of new genetic techniques to improve race identification and population estimates of Chinook smolts emigrating from the Delta. The proposal is well prepared, feasible, supports CALFED goals, and improves monitoring efforts that are fundamental components of Central Valley Chinook salmon management. The collaborative nature of the project and excellent use of matching funds are attractive. The results may influence major water management decisions.
Rating	Superior